DESCRIPTION

EMERGENCY BRAKE DEVICE FOR AN ELEVATOR

Technical Field

The present invention relates to an emergency brake device for an elevator.

Background Art

Conventionally, there are emergency brake devices in which an emergency stop or a speed governor is disposed on the counterweight side or which are provided with a rope brake that directly grips a main rope for cases where a car moves upwards at a speed higher than a rated speed due to a failure or accident in an elevator, due to an unbalance in weight between the elevator car and a counterweight, or the like.

Further, JP 5-193860 A discloses an emergency brake device having a braking bolt inserted between the spokes mounted to the shaft of the drive sheave.

Further, JP 6-199483 A discloses a brake device that stops a deflector sheave by pushing a wedge-like braking member between the sheave or the deflector sheave and the pressing member.

Further, JP 2002-241064 A discloses an emergency stop device in which wedge-like clamps are inserted on both sides of a car guide

rail and braking is applied by sandwiching the guide rail from the both sides.

However, each of the conventional emergency brake devices as described above requires a space dedicated for the provision of the brake device and is rather complex in structure. Further, with the emergency brake device in which the braking bolt is inserted between the spokes, there is a time lag between the engagement of the braking bolt with the spokes and the generation of a braking force, so there is a problem in that the speed of the car increases during this time lag. Further, with the device in which the wedge-like braking member or clamp is inserted, no mechanism is provided for releasing the mechanical engagement of the inserted braking member or clamp to enable a restart. Further, with the device provided with the rope brake that directly grips the main rope or the device in which the guide rail is sandwiched from both sides, there is a problem in that damage is caused to the rope or the guide rail.

It is an object of the present invention to provide an emergency brake device for an elevator which does not require a dedicated installation space, is simple in structure, allows easy releasing of a braking force, and does not cause damage to a rope or guide rail of the elevator.

Disclosure of the Invention

In view of the above-mentioned object, the present invention provides an emergency brake device for an elevator, characterized by including a brake shoe portion provided inside a sheave or deflector sheave of an elevator and having a brake shoe at a lower end of the brake shoe portion, the brake shoe generating a braking force due to friction upon abutting an inner wall of an outer peripheral frame of the sheave or deflector sheave at a time of braking, the brake shoe portion having built therein a spring mechanism provided between the brake shoe and a king pin, which is offset in a rotation direction of the sheave or deflector sheave with respect to a centerline passing through a rotation shaft of the sheave or deflector sheave and is fixed on a bearing side of the rotation shaft, the spring mechanism absorbing a force generated between the brake shoe and the king pin due to the braking force and being connected to the king pin at one end.

Brief Description of the Drawings

FIG. 1 is a view showing the construction of a traction type elevator apparatus equipped with an emergency brake device for an elevator according to the present invention;

Fig. 2 is a perspective view, partly in section, of an emergency brake when not in operation, showing an example of an emergency brake according to the present invention provided inside a sheave;

Fig. 3 is a perspective view, partly in section, of the emergency

brake of Fig. 2 when in operation;

Fig. 4 is a perspective side view, partly in section, of the emergency brake of Fig. 2 when not in operation; and

Fig. 5 is a diagram showing the schematic configuration of an elevator control system including an emergency brake device according to the present invention.

Best Mode for carrying out the Invention

Hereinbelow, embodiments of the present invention will be described with reference to the drawings.

Embodiment 1

Fig. 1 is a view showing the construction of a traction type elevator apparatus equipped with an emergency brake device for an elevator according to the present invention. In the traction type elevator apparatus, a car 3 and a counterweight 4, which are respectively raised and lowered along guide rails 3a, 4a within a hoistway, are connected with each other by a wire rope 2 and the wire rope 2 is wound around a hoisting machine sheave 1 and a deflector sheave 6 in the manner of a pulley, the car 3 being driven by utilizing the friction force between the wire rope 2 and the hoisting machine sheave 1. An emergency brake 5 according to the present invention is provided, for example, inside the sheave 1.

Fig. 2 through Fig. 4 are perspective views, partly in section, showing an example of the emergency brake 5 provided inside the

sheave 1. Fig. 2 and Fig. 3 are views basically along the line B-B of Fig. 4, respectively showing the emergency brake 5 when in operation and when not in operation. Fig. 4 is a view basically taken along the line A-A of Fig, 2, showing the emergency brake 5 when not in operation. It should be noted that reference symbols of only major components are shown in Fig. 3, Fig. 4 for the ease of understanding the overall construction. Referring to the drawings, the emergency brake 5 is composed of a brake shoe portion 50 provided with a pair of spring mechanisms 51, 52, and a drive portion 53 for moving (raising and lowering) the brake shoe portion 50 between a position where the brake shoe portion 50 is spaced from the inner wall of the outer peripheral frame of the sheave 1 and a position where the brake shoe portion 50 abuts the inner wall of the outer peripheral frame.

The brake shoe portion 50 has, inside a main portion 50a thereof, the pair of spring mechanisms 51, 52 that are arranged, within the surface of revolution of the sheave 1, in an upwardly open V-shaped configuration on both sides of the longitudinal centerline of the main body portion 50a in the state where the portion of the brake shoe 5a which abuts the inner wall of the outer peripheral frame (inner side of the outer peripheral surface) of the sheave 1 faces downwards. The spring mechanisms 51, 52 are of the same construction and are provided with compression coil springs 5e1, 5e2 with bolts 5g1, 5g2 serving as their shafts, respectively. Movable wedge portions 5i1, 5i2, and adjusting wedge portions 5h1, 5h2 are provided

on the lower and upper sides of the coil springs 5e1, 5e2, respectively.

The movable wedge portions 5i1, 5i2 are fixed to the main body portion 50a; when, as shown in Fig. 3, the main body portion 50a undergoes tilting (in actuality, such tilting includes minute lateral displacement) to stop the rotation of the sheave 1 when the emergency brake 5 is in operation, the movable wedge portions 5i1, 5i2 make relative upward movement along the bolts 5g1, 5g2 against the stress exerted by the coil springs 5e1, 5e2. Accordingly, gaps 5p1, 5p2 are formed such that fixing nuts 5j1, 5j2, which are respectively provided at the lower ends of the bolts 5g1, 5g2 to prevent the dislodging of the bolts 5g1, 5g2 from the movable wedge portions 5i1, 5i2, can move downwards with respect to the movable wedge portions 5i1, 5i2, respectively. The adjusting wedge portions 5h1, 5h2 are adjusted in their vertical positions by adjusting nuts 5c1, 5cb in order to adjust the stress exerted by the coil springs 5e1, 5e2, respectively. In the normal state, the coil springs 5e1, 5e2 are in the state of initial compression by means of the adjusting wedge portions 5h1, 5h2 and the adjusting nuts 5c1, 5cb, respectively, thus exerting an initial pressing force.

Provided at the respective upper ends of the spring mechanisms 51, 52 are movable support holes 5k1, 5k2 to be fitted with king pins 5f1, 5f2 fixed to a bearing 1b of a rotation shaft 1a (see the bearing on the left-hand side of Fig. 4) of the sheave 1.

Further, like the king pins 5f1, 5f2, the drive portion 53, which is shown in cross section in Figs. 2, 3 for the description of its inner structure, is fixed to the bearing 1b of the rotation shaft 1a (see the bearing on the left-hand side of Fig. 4) of the sheave 1. The drive portion 53 is equipped with a solenoid coil 5b, and a plunger 5d that is driven through the turning on and off of electric current to the solenoid coil 5b. A pin 5m for connection with the brake shoe portion 50 is provide at the lower end of the plunger 5d. When the pin 5m is fitted in a movable support hole 5n formed in the main body 50a of the brake shoe portion 50, this effects the connection with the brake shoe portion 50, thereby driving the brake shoe portion 50. That is, the brake shoe portion 50 is moved between the position as shown in Fig. 2 where it is spaced from the inner wall of the sheave 1 and the position as shown in Fig. 3 where it abuts the inner wall of the sheave 1, while being suspended by the pin 5m at the lower end of the plunger 5d. Thus, according to the configurations of the movable support holes 5k1, 5k2 and movable support hole 5n which will be describe later, the brake shoe portion 50 is capable of tilting by a predetermined angle to both sides with respect to the vertical centerline passing through the rotation shaft 1a.

The (first) movable support holes 5k1, 5k2 at the upper ends of the spring mechanisms 51, 52, and the (second) movable support hole 5n of the brake shoe portion 50, are formed as elongated circular

holes so as to allow the movement of the brake shoe portion 50 between the position as shown in Fig. 2 with the emergency brake 5 not in operation and the position as shown in Fig. 3 with the emergency brake 5 in operation. Although Fig. 3 shows the state where the sheave 1 rotates in the clockwise direction as indicated by the arrow R, the configurations of the movable support holes 5k1, 5k2 and of the movable support hole 5n are determined by also taking into consideration the case where the sheave 1 rotates in the counterclockwise direction reverse to the clockwise direction of Fig. 3.

Fig. 5 shows the schematic configuration of an elevator control system including the emergency brake device according to the present invention. Normally, when a passenger operates a call button installed in the landing or a destination button 103 installed within the car, an elevator control device 101 releases a service brake 113, and a hoisting machine 105 is driven to rotate the sheave 1, thereby raising and lowering the car 3 to carry the passenger. At this time, a speed detector 107 provided to the hoisting machine 105 performs feedback control on the raising and lowering speed. When the car 3 arrives at the target floor, the rotation of the hoisting machine 105 is stopped, and then the service brake 113 is activated to lock the rotation of the hoisting machine 105.

Then, by obtaining from the elevator control device 101 the status of a control command to the car 3, a speed abnormality detecting

section 109 monitors whether or not a speed abnormality (including an abnormality in the traveling direction) is occurring through checking of the actual behaviors (speed and orientation) of the car at that time by obtaining in the form of a detection signal from the speed detector 107 the rotation state of the hoisting machine 105. Upon finding the occurrence of a speed abnormality, such as when the car 3 is moving upwards at a speed higher than a rated speed or when the car 3 starts moving upwards or downwards even though the command signal indicates stoppage, the speed abnormality detecting section 109 instructs emergency brake driving section 111 to drive the emergency brake 5.

The emergency brake driving section 111, which has continuously supplied electric current to the solenoid coil 5b of the drive portion 53 of the emergency brake 5, cuts off the electric current supply. As a result, the brake shoe portion 50, which has been pulled up by the drive portion 53 as shown in Fig. 2, moves down to the position as shown in Fig. 3 where the brake shoe 5a at a lower portion of the brake shoe portion 50 abuts the inner wall of the outer peripheral frame of the sheave 1. Provided that, as shown in Fig. 3, the sheave 1 is rotating clockwise as indicated by the arrow R, the spring mechanism 51 is thus sandwiched between its abutting portion with the inner wall of the sheave 1 of the brake shoe 5a and the king pin 5f1, so the brake shoe 5a is pressed against the inner wall of the shave 1 by the spring force of the coil spring 5e1, thereby

stopping or preventing the rotation of the sheave 1.

It should be noted that the speed abnormality detecting section 109 and the emergency brake driving section 111 may be incorporated into the elevator control device 101 composed of a computer or the like together with other control functions.

That is, when, for example, the car 3 of the elevator moves, for example, in the upward direction at a speed higher than a rated speed, the speed abnormality detecting section 109 senses the abnormal speed, so the emergency brake driving section 111 cuts off the supply of electric current to the solenoid coil 5b. Accordingly, the brake shoe portion 50 is lowered by gravity so the brake shoe 5a provided at its lower portion is pressed against the sheave 1; as the sheave 1 rotates, the brake shoe portion 50, particularly its portion on the spring mechanism 51 side, is caught in between the sheave 1 and the king pin 5f1 due to the wedge effect and moves until equilibrium is reached between the spring force of the coil spring 5e1 and the braking force generated by the brake shoe 5a. In this way, the coil spring 5e1 undergoes further compression by a predetermined amount from its normal compression state to generate a fixed pressing force, whereby a braking force is generated between the brake shoe 5a and the sheave 1. Accordingly, the car 3 that is moving upwards is decelerated and stopped with a fixed braking force irrespective of the speed of the car 3.

It should be noted that while the foregoing description is

directed to the case where the car 3 moves upwards, the same operation and effect can be achieved in the case where the car 3 moves downwards as well, because the structure of the emergency brake 5 is symmetrical on the right and left sides of its centerline. Further, while in the foregoing description an abnormal speed of the car 3 traveling in the upward direction is sensed and the car is stopped, it is also possible, by abutting the brake shoe 5a against the inner wall of the sheave 1 while the car 3 is at rest, to prevent an abnormal ascent or decent of the car 3 not only when the car moves at an abnormal speed but also when the passengers get on or off the elevator while the car is at rest.

Further, the same effect as described above can be attained also when the emergency brake 5 is mounted in the deflector sheave 6 instead of in the hoisting machine sheave 1.

Industrial Applicability

The emergency brake according to the present invention is applicable not only to elevators but also to various rotary apparatuses to achieve the same enhanced safety as described above.